

## SURVEILLANCE REPORT

# Malaria

## Annual Epidemiological Report for 2022

### Key facts

- For 2022, 6 131 malaria cases were reported in the EU/EEA, all of which were confirmed.
- Among 5 375 cases with known importation status, 99.8% were travel-related. Thirteen confirmed cases were reported as acquired in the EU (seven in France, three in Germany, two in Spain, and one in Ireland).
- A marked seasonal trend was observed across all countries, with cases increasing during and immediately after the summer holiday months (July–September) most likely reflecting travel patterns to malaria-endemic countries.
- As in previous years, the overall rate of confirmed malaria cases was higher among men than women (1.1 and 0.4 cases per 100 000 population, respectively; male-to-female ratio: 2:1).

### Introduction

Malaria in humans is an acute or subacute infectious disease caused by one of six protozoan species of the genus *Plasmodium*: *P. falciparum*, *P. vivax*, *P. ovale wallikeri*, *P. ovale curtisi*, *P. malariae*, and *P. knowlesi*, transmitted by *Anopheles* mosquitoes. Occasionally, transmission occurs by blood transfusion, organ transplantation, needle-sharing, or congenitally from mother to foetus.

Malaria is one of the major global public health problems, having caused 249 million infections in 85 endemic countries and approximately 608 000 deaths in 2022 [1]. Malaria transmission occurs predominantly in Africa, Central and South America, Asia, and Oceania. Infections with *P. falciparum* and *P. vivax* represent the major part of the global burden of malaria.

There is no animal reservoir for *P. falciparum*, *P. vivax*, *P. ovale*, or *P. malariae*. Macaques are the animal reservoir of *P. knowlesi*.

## Methods

This report is based on data for 2022 retrieved from The European Surveillance System (TESSy) on 20 December 2023. TESSy is a system for the collection, analysis and dissemination of data on communicable diseases.

For a detailed description of methods used to produce this report, refer to the 'Methods' chapter [2].

An overview of the national surveillance systems is available online [3].

A subset of the data used for this report is available through ECDC's online 'Surveillance atlas of infectious diseases' [4].

For 2022, 28 European Union/European Economic Area (EU/EEA) countries reported data on malaria (Denmark and Luxembourg did not report). Twenty-six countries reported case-based data and two reported aggregated data (Belgium and Bulgaria). Twenty-six countries used the EU case definition, and two (France and Germany) used an alternative case definition. Surveillance is comprehensive and mostly passive. Reporting is compulsory in 26 countries, and voluntary in France and classified as 'other' in Belgium, where reporting is only compulsory for infections acquired within Europe. Therefore, no notification rate was calculated for Belgium and France.

## Epidemiology

For 2022, 6 131 malaria cases were reported in the EU/EEA, all of which were confirmed. France reported the highest number of cases, followed by Germany, Spain, Italy, and Belgium (Table 1, Figure 1).

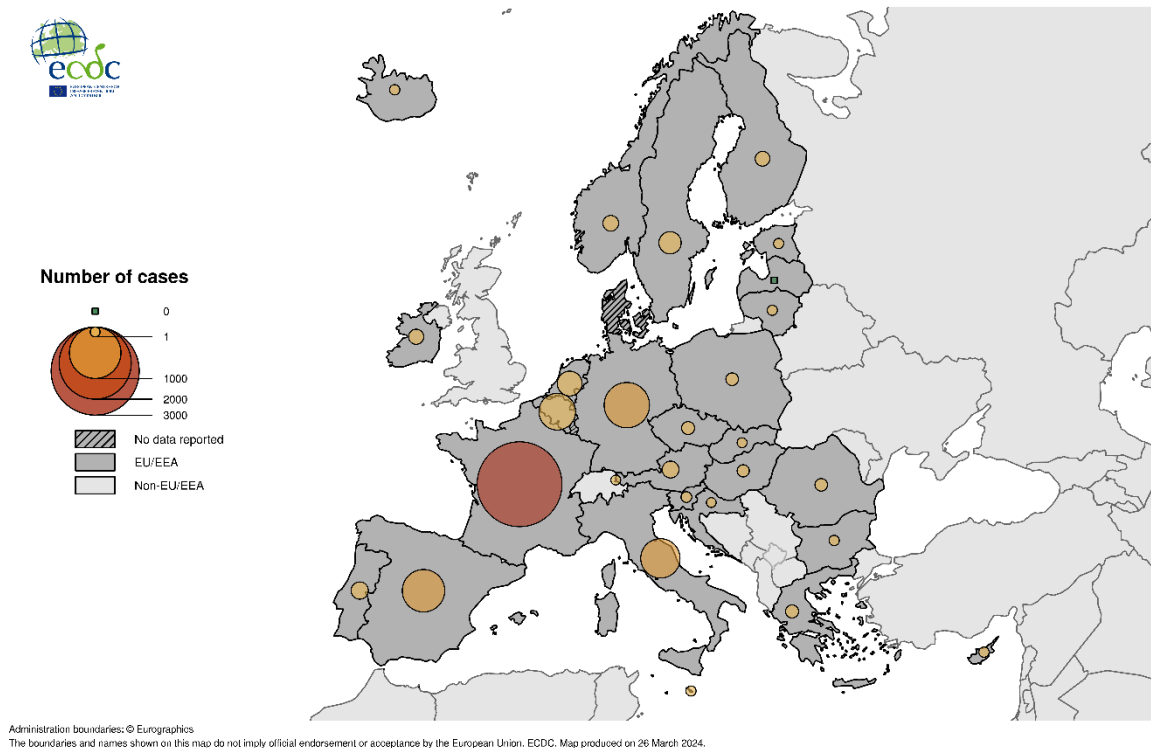
In 2022, the notification rate was highest in Liechtenstein (2.5 cases per 100 000 population, caused by a single reported case), followed by Sweden (1.5 cases per 100 000 population), Spain (1.4 per 100 000), and Iceland (1.3 per 100 000 population). Age-standardised notification rates (ASR) did not differ substantially from crude rates, apart from the rates for Liechtenstein (Table 1).

The overall notification rate was stable at 0.9–1.0 cases per 100 000 population during 2018 to 2019 (Table 1). A decrease was observed in 2020, when the lowest notification rate was observed (0.3 cases per 100 000), followed by an increase in 2021 and 2022 (0.6 and 0.8 cases per 100 000 population, respectively).

**Table 1. Confirmed malaria cases and rates per 100 000 population by country and year, EU/EEA, 2018–2022**

Country	2018		2019		2020		2021		2022		
	Number	Rate	Number	Rate	Number	Rate	Number	Rate	Number	Rate	ASR
Austria	62	0.7	72	0.8	27	0.3	37	0.4	74	0.8	0.9
Belgium	357	NRC	417	NRC	241	NRC	365	NRC	491	NRC	NRC
Bulgaria	8	0.1	8	0.1	5	0.1	9	0.1	5	0.1	0.1
Croatia	2	0.0	3	0.1	0	0.0	NDR	NRC	1	0.0	0.0
Cyprus	4	0.5	4	0.5	0	0.0	0	0.0	4	0.4	0.5
Czechia	34	0.3	32	0.3	9	0.1	10	0.1	29	0.3	0.3
Denmark	64	1.1	NDR	NRC	NDR	NRC	NDR	NRC	NDR	NRC	NRC
Estonia	3	0.2	3	0.2	1	0.1	3	0.2	4	0.3	0.3
Finland	34	0.6	50	0.9	52	0.9	39	0.7	48	0.9	1.0
France	2 840	NRC	2 839	NRC	1 007	NRC	2 321	NRC	2 783	NRC	NRC
Germany	900	1.1	999	1.2	366	0.4	613	0.7	768	0.9	1.0
Greece	55	0.5	40	0.4	23	0.2	32	0.3	30	0.3	0.3
Hungary	17	0.2	12	0.1	10	0.1	8	0.1	22	0.2	0.2
Iceland	3	0.9	4	1.1	0	0.0	7	1.9	5	1.3	1.3
Ireland	60	1.2	80	1.6	15	0.3	39	0.8	53	1.0	1.0
Italy	722	1.2	811	1.4	181	0.3	443	0.7	571	1.0	1.1
Latvia	4	0.2	4	0.2	0	0.0	0	0.0	0	0.0	0.0
Liechtenstein	NDR	NRC	NDR	NRC	NDR	NRC	0	0.0	1	2.5	2.9
Lithuania	6	0.2	7	0.3	0	0.0	3	0.1	4	0.1	0.2
Luxembourg	13	2.2	13	2.1	5	0.8	28	4.4	NDR	NRC	NRC
Malta	7	1.5	20	4.1	1	0.2	4	0.8	4	0.8	0.8
Netherlands	252	1.5	180	1.0	68	0.4	150	0.9	204	1.2	1.2
Norway	54	1.0	196	3.7	48	0.9	68	1.3	60	1.1	1.1
Poland	28	0.1	24	0.1	8	0.0	15	0.0	26	0.1	0.1
Portugal	102	1.0	116	1.1	59	0.6	79	0.8	81	0.8	0.8
Romania	18	0.1	22	0.1	2	0.0	7	0.0	25	0.1	0.1
Slovakia	3	0.1	6	0.1	2	0.0	5	0.1	2	0.0	0.0
Slovenia	3	0.1	6	0.3	2	0.1	3	0.1	9	0.4	0.4
Spain	851	1.8	783	1.7	210	0.4	430	0.9	669	1.4	1.4
Sweden	189	1.9	205	2.0	138	1.3	144	1.4	158	1.5	1.6
<b>EU/EEA (30 countries)</b>	<b>6 695</b>	<b>0.9</b>	<b>6 956</b>	<b>1.0</b>	<b>2 480</b>	<b>0.3</b>	<b>4 862</b>	<b>0.6</b>	<b>6 131</b>	<b>0.8</b>	<b>0.8</b>
United Kingdom	1 669	2.5	1 706	2.6	NDR	NRC	NA	NA	NA	NA	NA
<b>EU/EEA (31 countries)</b>	<b>8 364</b>	<b>1.2</b>	<b>8 662</b>	<b>1.2</b>	<b>2 480</b>	<b>0.3</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>

Source: country reports; ASR: age-standardised rate; NDR: no data reported; NRC: no rate calculated; NA: not applicable. No data from 2020 onwards were reported by the United Kingdom, due to its withdrawal from the EU on 31 January 2020.

**Figure 1. Confirmed malaria cases by country, EU/EEA, 2022**

Source: Country reports.

Among 5 388 cases with known importation status, 99.8% were travel-related. The majority of these cases (76.5%) were infected in West Africa.

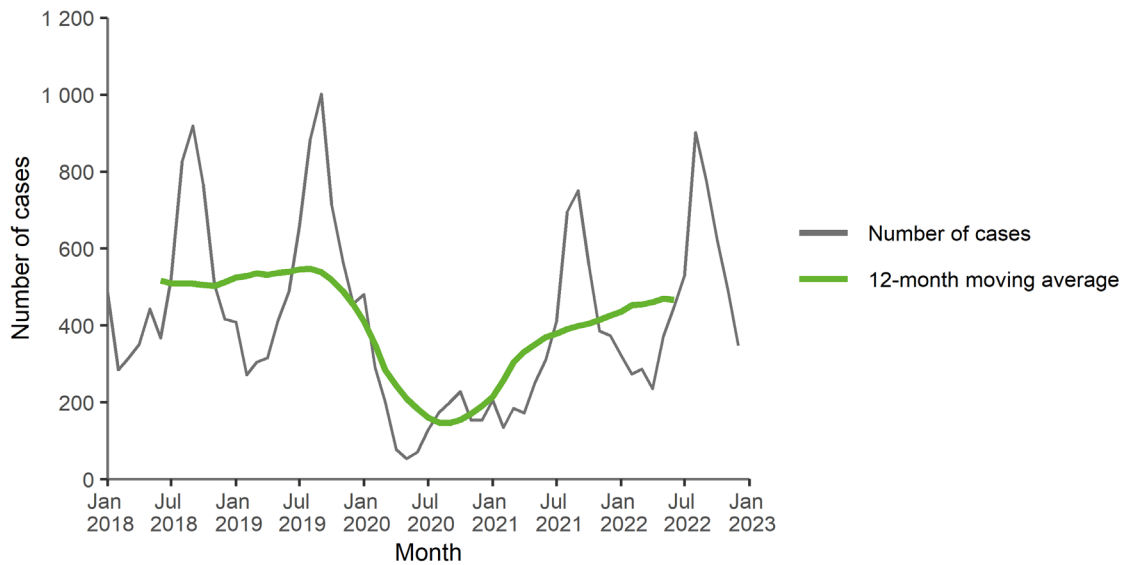
From [the EU's outermost regions](#), nine locally acquired cases of malaria (*Plasmodium vivax*) were reported from French Guiana, while zero locally acquired cases were reported from Martinique, Guadeloupe, Saint Martin, Réunion, Mayotte, Azores, Madeira, and the Canary Islands.

Thirteen confirmed *P. falciparum* cases were reported as locally acquired in the EU. Of those, eight cases were reported as airport-related (4 cases associated to four different French airports by France, a cluster of three cases among airport staff by Germany [5] and one case by Ireland); three cases were categorised as cryptic (epidemiologic investigations failed to identify an apparent mode of acquisition) by France; and two cases were reported as hospital-acquired by Spain [6].

Of 5 635 confirmed cases for which the pathogen was reported, 4 831 (85.7%) had *P. falciparum*, 123 (2.2 %) had *P. vivax*, 249 (4.4 %) had *P. ovale*, 174 (3.1%) had *P. malariae*, and 250 (4.4%) cases had infections with unspecified *Plasmodium* species. There were eight cases with mixed infections. The case fatality was 0.6% among all 2 827 malaria cases with a known outcome (16 deaths were reported).

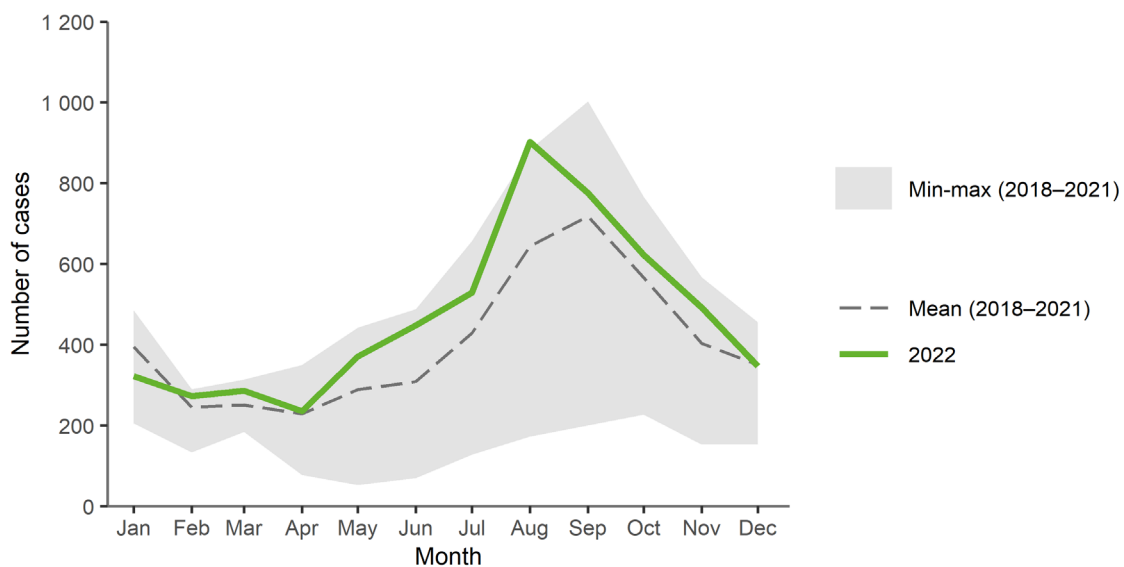
A marked seasonal pattern was observed across the 25 countries consistently reporting malaria during 2018, 2019, 2021, and 2022, with cases increasing during and immediately after the summer holiday months (July–September). In 2020, there was no seasonal pattern, probably as an effect of travel restrictions due to the COVID-19 pandemic (Figure 2).

**Figure 2. Confirmed malaria cases by month, EU/EEA, 2018–2022**



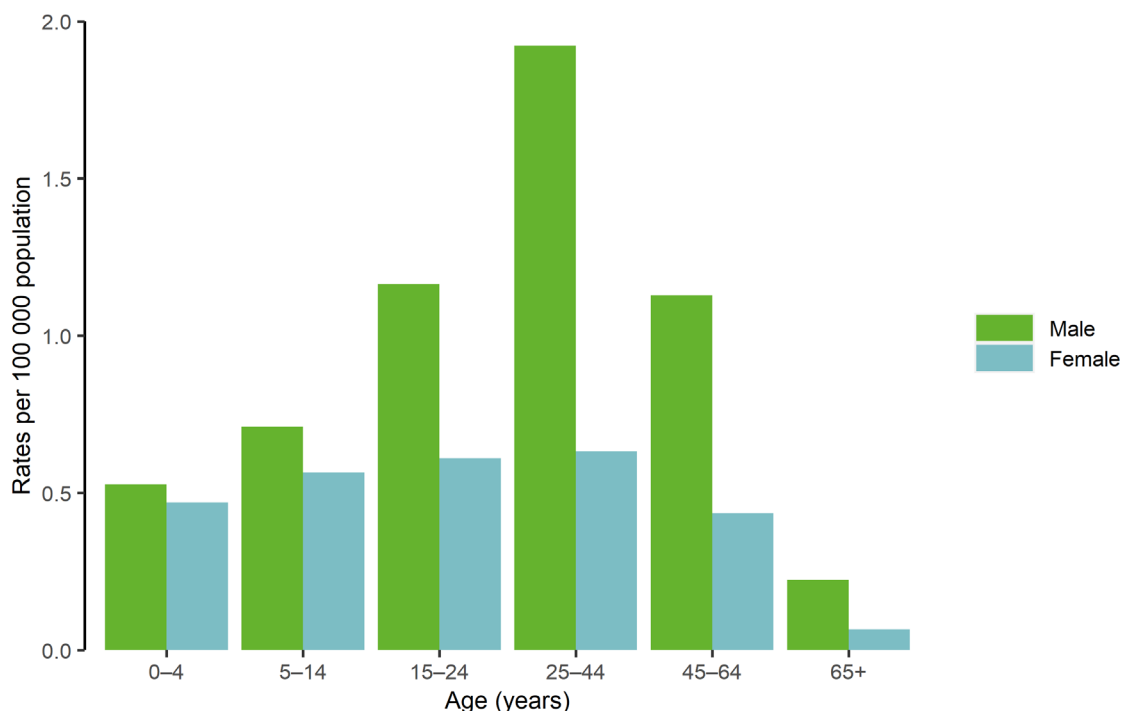
Source: Country reports from Austria, Cyprus, Czechia, Estonia, Finland, France, Germany, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, and Sweden.

**Figure 3. Confirmed malaria cases by month, EU/EEA, 2022 and 2018–2021**



Source: Country reports from Austria, Cyprus, Czechia, Estonia, Finland, France, Germany, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, and Sweden.

In 2022, the overall rate of confirmed malaria cases was higher among men than women (1.1 and 0.4 cases per 100 000 population, respectively; male-to-female ratio: 2:1). In both men and women, the notification rate was highest in the age group 25–44 years (1.9 and 0.6 cases per 100 000 population, respectively), followed by 15–24 years (Figure 4).

**Figure 4. Confirmed malaria rates per 100 000 population, by age and gender, EU/EEA, 2022**

Source: Country reports from Austria, Belgium, Bulgaria, Croatia, Cyprus, Czechia, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Liechtenstein, Lithuania, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, and Sweden.

## Discussion

The World Health Organization estimated that there were 249 million malaria cases globally in 2022, five million more than in 2021 [1]. The increase was predominantly observed in Pakistan, Ethiopia, Nigeria, Uganda, and Papua New Guinea.

*Plasmodium falciparum* is the most prevalent malaria parasite in West Africa (almost 100%), Central Africa (100%), high transmission countries in East and Southern Africa (almost 100%), low transmission countries in East and Southern Africa (91%), the Eastern Mediterranean (71%), the Western Pacific (73%), and South-East Asia (54%), while *P. vivax* is the dominant malaria species in the Americas (72%) [1]. Notification rates in the EU/EEA were substantially lower in 2020, 2021 and 2022 compared to previous years (2018–2019). The number of cases reported in 2020 was likely affected by the COVID-19 pandemic, but other factors might have contributed (e.g. diagnostic capacity and surveillance in EU/EEA countries). Travel restrictions, as well as personal behavioural changes, resulted in a decrease in travel to endemic areas, which is the main driver of malaria cases in the EU/EEA. The increasing numbers of cases in 2021 and 2022 probably reflects the lifting of the travel restrictions [7].

Nearly all malaria cases reported by EU/EEA countries for 2022 were imported. The countries reporting the highest numbers of cases have historical, economic, linguistic, and cultural links with endemic areas, particularly in Africa and the Americas. Most of the imported malaria cases in France and Spain are linked to travel routes from West Africa [8]. Seasonality and age distribution of cases in Europe most likely reflect travel patterns to malaria-endemic countries. The literature suggests that a substantial proportion of imported malaria cases in the EU/EEA occur among recent immigrants from malaria-endemic countries and more settled migrants who have travelled to visit friends and relatives in malaria-endemic countries [9]. Outside Europe, certain EU outermost regions are endemic for malaria, including French Guiana and Mayotte. Data about cases among residents of these regions are not collected through TESSy.

As in previous years, a small number of sporadic autochthonous malaria cases were reported in the EU/EEA in 2022, but no sustained transmission has been reported. Of note, in 2022, in addition to the eight cases classified as airport malaria mentioned above, Belgium\* also reported one case of airport malaria [10].

\* Belgium does not separately report autochthonous cases in its aggregated reporting to TESSy.

## Public health implications

Awareness about malaria among clinicians and travellers, particularly among people visiting friends and relatives in malaria-endemic countries, should remain a focus of attention. Individuals visiting friends and relatives in malaria-endemic countries often have an incorrect risk perception and are less likely than other travellers to seek pre-travel advice and use the recommended malaria prevention measures. In addition, the duration of their trips tends to be longer, increasing the risk of exposure [11]. In Europe, malaria chemoprophylaxis is only recommended for travellers to malaria-endemic countries. The choice of prophylactic drugs and prevention measures depends mainly on local malaria epidemiology, duration of potential exposure to vectors, parasite resistance patterns, level and seasonality of transmission, prophylactic drug tolerance, age, and pregnancy. As a result of the nocturnal feeding habits of most *Anopheles* mosquitoes, protection measures against mosquito bites include the use of (preferably long-lasting insecticidal) bed nets, clothes that cover most of the body, and insect repellent on exposed skin.

With regard to malaria transmission through substances of human origin (e.g. blood products or organ transplants), vigilance should remain high. In addition, healthcare providers should be aware that hospital transmission of malaria is rare but possible, irrespective of the *Plasmodium* species involved. Clinicians should therefore consider the possibility of hospital-acquired malaria in hospitalised or recently discharged patients who develop an unexplained fever or malaria-like clinical syndrome, especially if their hospital admission coincided with that of another patient admitted with malaria [12].

As *Anopheles* mosquitoes are widely present in Europe, local vectorial transmission of *Plasmodium* following introduction of the parasite by a travel-related case remains possible in the EU/EEA. Although airport malaria is rare, *Plasmodium* transmission via mosquitos imported from endemic areas sporadically occur.

Malaria remains a risk to the EU/EEA, and there is a need for continuous malaria surveillance, preparedness, and prevention in the EU/EEA.

## References

1. World Health Organisation (WHO). World malaria report 2023. Geneva: WHO; 2023. Available at: <https://www.who.int/teams/global-malaria-programme/reports/world-malaria-report-2023>
2. European Centre for Disease Prevention and Control (ECDC). Introduction to the Annual epidemiological report. Stockholm: ECDC; 2023. Available at: <https://www.ecdc.europa.eu/en/surveillance-and-disease-data/annual-epidemiological-reports/introduction-annual>
3. European Centre for Disease Prevention and Control (ECDC). Surveillance systems overview for 2022. Stockholm: ECDC; 2023. Available at: <https://www.ecdc.europa.eu/en/publications-data/surveillance-systems-overview-2022>
4. European Centre for Disease Prevention and Control (ECDC). Surveillance Atlas of Infectious Diseases. Stockholm: ECDC; 2023. Available at: <http://atlas.ecdc.europa.eu/public/index.aspx>
5. Kessel J, Rosanas-Urgell A, Dingwerth T, Goetsch U, Haller J, Huits R, et al. Investigation of an airport-associated cluster of falciparum malaria in Frankfurt, Germany, 2022. Euro Surveill. 2024 Feb;29(5) Available at: <https://www.ncbi.nlm.nih.gov/pubmed/38304950>
6. Verona Mesia B, Lopez-Ruiz N, Duran-Pla E. Epidemiological investigation of a case of malaria in a non-endemic area, Campo de Gibraltar, Cadiz, Spain, January 2022. Euro Surveill. 2022 Nov;27(46) Available at: <https://www.ncbi.nlm.nih.gov/pubmed/36398577>
7. Schultz JS, Mace KE, Tan KR. Return to Travel in the Coronavirus Disease 2019 Pandemic Recovery Period and Implications for Imported Malaria: Reinforcing Prevention, Early Diagnosis, and Appropriate Treatment of Malaria. Clin Infect Dis. 2023 Apr 3;76(7):1161-3. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/36723870>
8. Tatem AJ, Jia P, Ordanovich D, Falkner M, Huang Z, Howes R, et al. The geography of imported malaria to non-endemic countries: a meta-analysis of nationally reported statistics. Lancet Infect Dis. 2017 Jan;17(1):98-107. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/27777030>
9. European Centre for Disease Prevention and Control (ECDC). Assessing the burden of key infectious diseases affecting migrant populations in the EU/EEA. Stockholm: ECDC; 2014. Available at: <https://ecdc.europa.eu/en/publications-data/assessing-burden-key-infectious-diseases-affecting-migrant-populations-eueea#no-link>
10. Sciensano. Primary Risk Assessment: Autochthonous Malaria Case in Steenokkerzeel, 2022. Available at: [https://www.sciensano.be/sites/default/files/pr\\_a\\_autochthonous\\_malaria\\_290622\\_final\\_1.pdf](https://www.sciensano.be/sites/default/files/pr_a_autochthonous_malaria_290622_final_1.pdf)
11. Centers for Disease Control and Prevention (CDC). Recommendations for Immigrants from Malaria-Endemic Countries Planning to Return "Home" to Visit Friends and Relatives. Atlanta: CDC; 2018. Available at: <https://www.cdc.gov/malaria/travelers/vfr.html>
12. European Centre for Disease Prevention and Control (ECDC). Rapid Risk Assessment: Hospital-acquired malaria infections in the European Union. Stockholm: ECDC; 2018. Available at: <https://ecdc.europa.eu/sites/portal/files/documents/2018-04-30-RRA-Hospital-acquired-Malaria-European-Union-with%20erratum-1.pdf>